

multiple servers cannot be utilised due to slow handover procedures through some gain can be expected. In CDMA soft handover enables utilisation of the full gain.

4.2 Building and vehicle penetration

Building penetration loss is loss due to roofs, walls and floors. Building penetration loss varies according to building type. When indoor coverage is important, the average building penetration loss and standard deviation indoors should be known to calculate corresponding slow fading margins. If measurement results are not available the values can be estimated, for example, according to the ETSI GSM recommendation 03.30 in which building penetration loss in urban areas is estimated to be 15–18 dB and in rural areas 10 dB depending on the frequency used.[4] For standard deviation indoors default values of 9–11 dB can be used. It should be noted that some studies have shown that the average penetration loss for some types of building decrease when the frequency is increased, e.g. from 900 MHz to 1800 MHz.

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Figure 4: This selection from a book titled, “Radio Interface System Planning for GSM/GPRS/UMTS¹⁹,” (Manninen), states that studies show that as frequency is increased, building penetration loss generally decreases.

¹⁹ <http://www.google.com/search?q=Radio+Interface+System+Planning+for+GSM%2FGPRS%2FUMTS>

Outdoor-to-Indoor Measurements

- **Penetration/"Building Loss"**
 - Depends on building materials, orientation, layout, height, percentage of windows, transmission frequency
 - » Received signal strength increases with increasing height of building (less urban clutter at upper floors)
 - » Penetration loss decreases with increasing frequency
 - » 6 dB less loss through windows
- **Rate of decay/distance power law: 3.0 to 6.2, with average of 4.5**
- **Building attenuation loss: between 2 dB and 38 dB**



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Figure 5: This slide, from a presentation by Prof. Randy H. Katz, "CS-294-7: Radio Propagation"²⁰, describes that building penetration loss decreases with increasing frequency.

²⁰ <http://www.sss-mag.com/pdf/1propagation.pdf>

Building penetration characteristics of 880 MHz and 1922 MHz radiowaves

Tanis, W.J., II Pilato, G.J.

This paper appears in: Vehicular Technology Conference, 1993 IEEE 43rd

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Abstract

The data gathered revealed the effects of frequency, environment, and building height on the penetration loss, as well as information about building shadow loss at each frequency. Building penetration loss averages 19.2 dB for 880 MHz and 15.7 dB for 1922 MHz. The signal strength generally increases at higher floors within the building, but tends to level off at heights above the fifth floor. Exceptions to this are found in a high-rise office complex. Building shadowing effects are generally less at 1922 MHz

Figure 6: This abstract of a IEEE peer-reviewed article, "Building penetration characteristics of 880 MHz and 1922 MHz radiowaves"²¹, concludes that the building penetration at the higher frequency of 1922 MHz is better than it is at the lower frequency.

difference between the local mean and the total mean of the field strength levels inside the building for the measurements of fig. 8

2) *Small scale signal variation* is Rice distributed with different values of the Rice factor c between 0 (see Fig. 11, Rayleigh distribution) and 5 (see fig. 12).

These results agree very well with the statements given in [1], [2] and [3]. The mean building penetration loss from our measurements is in the range of 10 dB (see tab. 2). From table 2 follows that the building penetration loss (BPL) depends only slightly on frequency (building penetration loss increases with increasing frequency).

MEASUREMENT RESULTS

Frequency / MHz	BPL-Values $\bar{F}_{outdoor} - \bar{F}_{indoor}$	Std.Dev. $\sigma_{outdoor}$	Std.Dev. σ_{indoor}
230 (T1)	3,4 dB	17,5 dB	13,3 dB
230 (T2)	10,4 dB	8,9 dB	7,6 dB
1500 (T3)	10,9 dB	8,4 dB	7,1 dB
1500 (T4)	9,7 dB	9,6 dB	8,7 dB
230 (DAB)	7,5 dB	4,3 dB	6,0 dB
1500 (DAB)	9,3 dB	2,7 dB	4,0 dB

Tab. 2: Overview of the measurement results

Figure 7: The author of this IEEE peer reviewed article, "Measurement of Building Penetration Loss and Propagation Models for Radio Transmission into Buildings"²², concludes that "building penetration loss (BPL) depends only slightly on frequency," showing that BPL increases only slightly with increasing frequency.

²¹ <http://www.google.com/search?q=building+penetration+characteristics+880+1922+MHz>

²² <http://www.google.com/search?q=building+penetration+loss+hoppe>

Propagation & Band Characteristics

- VHF Low Band (30-50 MHz)
 - Best propagation in undeveloped and hilly terrain
 - Poor building penetration
- VHF High Band (150-174 MHz)
 - Very good propagation in undeveloped and hilly terrain
 - Moderate building penetration
- UHF (450-512 MHz)
 - Good propagation in undeveloped and hilly terrain
 - Good building penetration
- 700/800 MHz
 - Poor propagation in undeveloped and hilly terrain
 - Very good building penetration
 - 700 currently subject to incumbent television stations in some areas
 - 800 currently subject to interference from commercial carriers

Figure 8: This Power Point presentation²³ by Bill DeCamp, California Department of General Services Telecommunication Division, documents that 700/800 MHz exhibits “very good” building penetration. The slide shows that as frequency is reduced, building penetration is poorer.

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[http://rimsinland.oes.ca.gov/Operational/OESHome.nsf/c0dabaaead977b0088256c2a006577e5/b66b2818ff03a8ce8825722e0074fc7e/\\$FILE/WDC%20Comm%20PPT.pdf](http://rimsinland.oes.ca.gov/Operational/OESHome.nsf/c0dabaaead977b0088256c2a006577e5/b66b2818ff03a8ce8825722e0074fc7e/$FILE/WDC%20Comm%20PPT.pdf)

EXHIBIT B

Analysis of Recon Robotics Testing on 450 and 900 MHz

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In an *ex parte* filing in this proceeding dated 11/4/2008, “Empirical Study of the Effects of 434 MHz vs. 915 MHz Frequency Band on the Performance of the Recon Scout,”²⁴ Recon Robotics makes the claim that their testing shows that propagation within a building is significantly worse on 900 MHz than it is on 450 MHz. This study contradicts numerous other studies showing that there is no significant difference, or even a modest advantage to operation on 900 MHz. An ARRL study, provided to the Commission simultaneously with this document, demonstrates the broad consensus that building penetration is not generally better at 450 MHz than it is at higher frequencies.

The Recon Robotics testing study contains a number of technical flaws and discrepancies. The most significant are:

- Too few buildings were tested to represent the wide range of buildings and building penetration likely to be encountered in real-world environments
- The only testing that was done was within intact buildings, instead of the compromised buildings that represent a major market for these products.
- The testing was done using antennas of dissimilar capture area on 450 and 900 MHz
- Too few points were tested to justify any conclusions about the overall value of building penetration in the buildings tested
- The test data reported are not self consistent, with numerous glaring discrepancies that are not explained in any of the discussion of the test results

Number of Buildings Tested and Types of Buildings Insufficient to Demonstrate the Wide Range of Conditions Apt to be Encountered In the Use of These Devices

Their choice of building is biased towards the results reported. While according to Recon Robotics’ own filings, these devices are intended to be deployed in a multitude of buildings, the choice of building is going to result in more instances of wall penetration through lossy media than will be found in many of the multitude of buildings where it would like to deploy this product. A building with windows, or a different wall construction, would have probably shown the slight increase in the effectiveness of 900

²⁴ Available on the FCC ECFS at
http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6520183779.

MHz vs 420 MHz, as evidenced by the various papers listed as references in ARRL's other study on this subject.

Antennas on Test Frequencies Have Different Capture Areas

The testing also used quarter-wave antennas for receive purposes. While this can provide a convenient reference for analysis purpose, in practice, it is not the way that most receivers will be configured. Recon Robotics is correct that adding a larger antenna to the transmitter would be both impractical and ill advised. In fact, operation at 900 MHz allows a *smaller* antenna on the transmitter without compromising performance (while also offering a slight benefit of reduced weight of the device). But when receiving signals, no constraints exist on the gain of the receive antenna and it would be typical for a receiver to use a small gain antenna on each band, of approximately the same physical size, where the higher-frequency antenna would have a larger capture area and thus more gain. The approximately 8 dB of additional "loss" of the higher frequencies would be completely negated by using a small Yagi or other gain antenna for the receiver on 900 MHz, (also minimizing multi-path propagation and received noise). To use an antenna that maximizes those problems instead of minimizes them, where the physical antenna size for a given capture area on each band tested would be about the same, is simply not good engineering testing.

Too Few Measurement Points

A study that uses only a few points inside a building runs a very real likelihood of having many of the points selected enhanced or degraded by the scattering effects that impact the signal level at any point within that building. A measurement at a single point within a building is a valid measurement of the signal level at that point, but it is of little use in making decisions about necessary power level, best frequency to use for a particular application and other factors that may have prompted the need for the study in the first place. Even a study that selected a small number of points within a building will generally not have enough of those points be representative of the average propagation characteristics within that building. The variations between those points are generally going to be much greater than any result that may be inferred from the data associated with them.

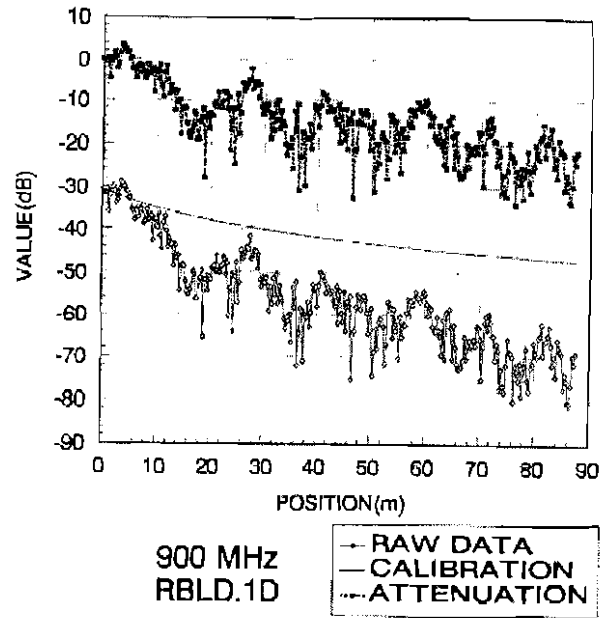


Figure 10. Raw data, free-space correction factor, and penetration attenuation versus distance for a typical 900-MHz measurement in the Radio Building.

Figure 1: These data, taken from NTIA Report 94-306, show that a change in location within a building of as little as 1 meter can change the strength of a measured or calculated signal by as much as 15 dB in this case. It is not possible to determine the characteristics of a building from a small number of data points.

Test Results Not Self Consistent

The following Table 2 is excerpted from Recon Robotics' 11/4/2008 filing.

Table 2 provides the readings from the spectrum analyzer along with the subjective rating of the video quality in each of the 8 positions. The distance is the approximate linear distance between the source Recon Scouts and the OCU. Images of the OCUs were also taken in each of the positions (R1 through R8) and are shown in Figure 8 through Figure 15. Note that in each of these pictures, the 434 MHz OCU is on the right.

Table 2: Readings from Spectrum Analyzer and Subjective Ratings of Video

Location	Apx Distance (m)	# of Walls	434 MHz Reading	434 MHz Rating	915 MHz Reading	915 MHz Rating
R2	3.4	0	-24 dBm	5	-27 dBm	4
R1	18.3	3	-51 dBm	5	-59 dBm	3
R7	26.8	1	-67 dBm	4	-65 dBm	5
R8	29.2	3	-72 dBm	3	-82 dBm	2
R3	33.3	5	-71 dBm	4	-80 dBm	1
R4	34.5	6	-72 dBm	2	-78 dBm	1
R6	37.7	6	-55 dBm	4	-63 dBm	1
R5	39.6	9	-59 dBm	5	-74 dBm	4

The filing purports to show that reception on 900 MHz is significantly worse than it is on 450 MHz. The self inconsistencies in the table and results are significant enough that these data cannot be used to reach that conclusion.

The table shows the received signal levels and reported picture quality from various "R" locations. The correlation between those signal levels and what is reported as being picture quality is a mystery at best.

For example, from location R2, a received signal level of -24 dBm or -27 dBm is an excellent signal on any band (corresponding to an approximate field strength of 99 dBuV/m. A video signal of this level should consistently provide picture-perfect reception. Yet, in its study, on 900 MHz, the signal is reported as having a rating of "4," simply not in agreement with a signal of that level. Later in the table, a received signal level of -65 dBm on 900 MHz is appropriately reported as a "5," picture-perfect.

Other examples of discrepancies between the reported measured signal levels and the picture quality are seen in the table. The most glaring is seen in a comparison between the claimed levels and signal quality at R7 on 434 MHz and R6 on 900 MHz. The level on 900 MHz is at -63 dBm, fully 4 dB stronger than the level of -67 dBm on 434 MHz, yet the signal is reported to be "unusable" at 900 MHz, even though it is 4 dB stronger than a signal reported as "good" on 434 MHz.

Although these are the most egregious discrepancies, there are other inconsistencies that are equally inexplicable, in both directions. It cannot be determined from these data what the fundamental test methodology error is, but if noise or other factors were to explain this, good scientific method should have dictated that the test report fully document all factors that impact the results that significantly. Such serious discrepancies call the entire test results into question, especially when coupled with an analysis of peer reviewed literature that show that there is not a significant difference in the overall propagation of signals of both frequency ranges through a wide variety of buildings.

EXHIBIT C

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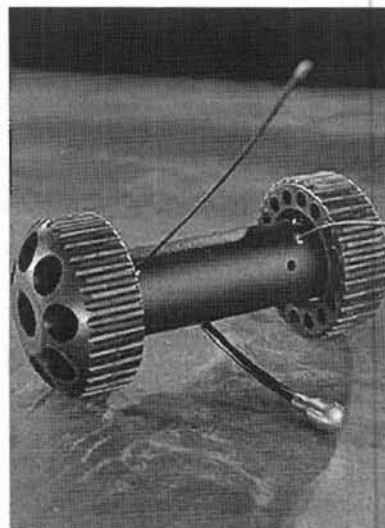
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Marietta, Georgia, Police Department - SWAT

Saving Lives on Tactical Operations

Marietta, Georgia, is a busy urban city of 60,000 people located just northwest of Atlanta.

Sergeant Jake King has been with the Marietta police department for 11 years and a member of the SWAT team for eight years. In early 2009, just a few months after he was appointed tactical commander, Sgt. King tested and evaluated the Recon Scout® IR miniature reconnaissance robot. It didn't take him long to see how it would fit into their tactical operations.

"The very first time I used the Recon Scout IR I thought 'this is a piece of equipment that will single-handedly save lives,'" says King. "You know, body armor is great as long as you get shot in the armored portion of your vest, but the Recon Scout is something that can save lives simply by providing critical information to our tactical team. It can keep us out of very dangerous situations."

A 3 A.M. Wake Up Call

The Marietta PD purchased a Recon Scout IR almost immediately after their evaluation, but their first use of the robot took place even before their robot was delivered. "We had already ordered our robot and were awaiting delivery when we had a specific call out involving a guy with a rifle inside a gas station and convenience store," says King. "We did not feel safe barging in there and we needed more information about the suspect's location, so we called up our ReconRobotics rep. He got out of bed at 3 A.M. and delivered one of his robots to the scene."

When the robot arrived the tactical team threw a hostage negotiation phone and the Recon Scout IR into the store. For the next few minutes as negotiators were attempting to make contact with the suspect using the phone, another officer was using the robot to search the aisles, counter area and bathrooms inside the store. King then positioned the robot to watch two closed doors at the back of the store and introduced gas. When no suspect emerged, the team breached the back door and cleared the two remaining rooms, finding no suspect.

"The beauty of the Recon Scout was that it was watching those doors throughout the entire operation, so if one of them moved or was opened we would be able to immediately notify the entry team," says King.

Are His Hands Empty?

In June 2009, Marietta took delivery of its own Recon Scout IR and the tactical team began bringing it with them on all high-risk warrant operations, making it a primary part of the entry team's gear. Just a few weeks after delivery of their robot the team received a call out involving a home invasion suspect who had been shot



"The very first time I used the Recon Scout IR I thought 'this is a piece of equipment that will single-handedly save lives.'"

— Sergeant Jake King, Tactical Commander,
Marietta PD SWAT

and was now in his own residence. "We knew the suspect was inside the home, so at the same time we launched CS gas through the windows, we threw the Recon Scout through another window," says King. "We were then able to search the house with the robot, and because the robot is so small and quiet he never saw it. When we located him in the bedroom we backed the robot underneath a table outside the bedroom and we watched him move in and out."

"After a few minutes the suspect hid his pistol and the robot watched as he walked to the front door with his hands up. The officer who was watching the video on the monitor alerted the team that the suspect was coming to the door and his hands were empty. You can't put a value on that information. It reduces risk to everyone involved," says King.

Since that time, the Marietta PD tactical team has used their robot on additional tactical call outs, and it has become routine for them to throw the robot into an environment at the same time that they introduce gas or use a flash bang or other diversion. "Once we get the robot inside, it gives us a big advantage, especially when its dark and the infra-red optics kick in," says King. "We can use the robot to scout for us and identify doorways and clear rooms. When the team moves in they already know what to look for and where the threats might come from."

Above all, the team finds the one-pound robot to be extremely simple to integrate into their operations. "What our team really likes is that it can be easily carried in an entry team backpack and when you need to use it, you simply grab it, pull the pin and throw in the robot," says King. "We even hook it to our 26-inch batons and use them to get a 360-degree view into attics. In any situation where we are uncertain about what lies ahead, we use the robot. You know, we're SWAT guys with body armor and fully automatic

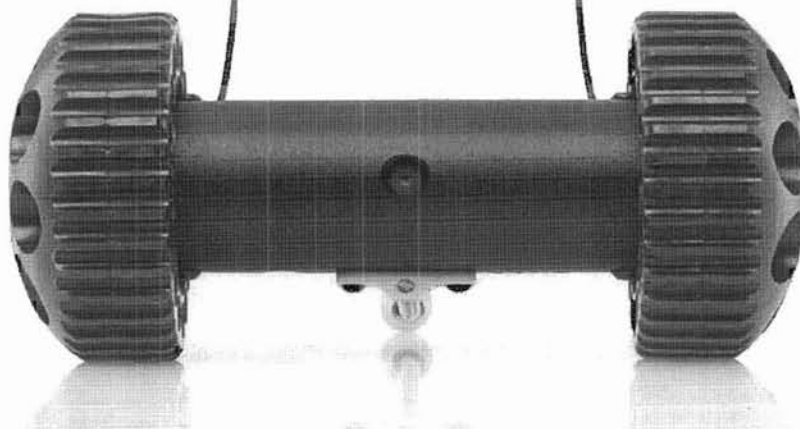
weapons, but we take a few seconds to send our robot ahead to make sure there's not a guy in the corner with a gun. We do it every time we can. I don't want anyone on our team getting hurt."

Using Two Robots Simultaneously

Soon Marietta PD will also take delivery of a new SWAT truck. When that arrives, the tactical team will also be able to use its Recon Scout command monitoring station, which allows the robot video to be viewed simultaneously in the command truck and by the tactical officer directing the robot using the hand-held operator control unit. This will allow real-time coordination of tactical team operations using video reconnaissance from inside the environment. "Our commanders will be able to see what the robot sees, and coordinate the movement of the tactical teams," says King. "In time we also hope to get a second Recon Scout that operates on a different frequency so we can use two robots simultaneously on the same operation. This will help us clear a structure much more quickly."

Summary

- | | |
|------------------|--|
| Agency | • Marietta Police Department
Marietta, Georgia, Population: 60,000 |
| Sector | • Police Tactical |
| Challenge | • Protect tactical team members during searches and high-risk warrant operations
• Determine location and status of suspects |
| Solution | • Recon Scout IR mobile reconnaissance robot and command monitoring station |
| Benefits | • Robot is used to identify and locate threats
• Tactical team is able to act with greater confidence and safety
• Most suspects do not know the robot is in the environment |



"At no point did we let down our guard, but we did feel much more confident about the situation before putting the officers in harm's way. That is the greatest value of the Recon Scout - it gives you greater certainty in handling a situation. It lets you know what you're up against."

- Sergeant Ron Davis, assistant tactical team leader,
Huntington Park, CA, police department

Huntington Park, CA, is a small, high-density city sandwiched between Los Angeles and South Central Los Angeles. Just three square miles in area, Huntington Park has a population of 65,000.

Sergeant Ron Davis has been with the Huntington Park Police Department for 15 years, and a member of the tactical team for the past eight years. He is currently the assistant commander of the tactical team, and as such, has the opportunity to introduce the team to new tools and technology.

In May 2007, then assistant chief, Paul Wadley, purchased the department's first tactical reconnaissance robot and introduced it to Sergeant Davis and the tactical team during their monthly training session. According to Sergeant Davis, he knew right away that this would be a valuable new tool for the team.

"When we first saw the Recon Scout, we were struck by how small and quiet it was," says Davis. "And best of all, we found out that you could throw it - over a wall, through a window or in an open entry door - and it would always land right-side up, ready to roll. You could then drive it around, and the reconnaissance video it sent back to the control unit was clear and crisp. Our minds were full of situations where we could use this technology."

Summary

Agency Huntington Park Police Department
Huntington Park, California
Population: 65,000

Sector Police Tactical

Challenge

- Gain greater certainty about the presence and status of potentially dangerous suspects
- Obtain real-time video of un-cleared spaces as tactical teams enter an environment

Solution

- Entry team deploys a Recon Scout mobile reconnaissance robot to assist in locating suspects.

Benefits

- Robot is very small and can be carried in by hand or in a pocket or pouch
- Robot can be thrown through a window or door
- Can be driven remotely to explore an environment without putting a team in the room
- Gives entry teams greater confidence in entering an environment
- Reduces damage to property

For more information
about the Recon Scout
throwable reconnaissance
robot, please call
1-866-697-6267 or visit
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RECON  **ROBOTICS**

Over the next few months, the entire tactical team became very familiar with the operation of the Recon Scout and its control unit. They used it in a variety of training scenarios and when the day came to put it to the test, they were ready to go.

"One of our first uses of the Recon Scout was on a patrol call to a domestic violence incident," says Davis. "When the officers arrived, they were told that the suspect had recently left the house and entered a detached garage at

the rear of the property. This garage had been converted into a living area and when the officers checked the door, they found that it was locked. A window at the rear of the garage was open however, so they immediately surrounded the garage area, and two of the team members, Detectives Castelli and Navia, grabbed the Recon Scout robot. They wanted to see if the suspect was inside the structure, and whether he was armed or not, before sending in the patrol officers."

The rest of the squad gained access to the back of the garage through a neighbor's yard and threw the Recon Scout through the window. It landed on the floor of the garage and immediately began sending video back to the controller, which was in the hand of Detective Neil Castelli, who was positioned nearby.

We used the robot to scan the room and identify the potential hiding spaces for the suspect," says Davis. "There was a bed and other furniture in the room along with a makeshift closet in the corner. We could see a shoe sticking out from under the bed, so the detective drove the robot directly to the bed so we could see under it. The suspect was not there. We then drove the robot around the room, looking in all the places where the suspect could potentially hide and found nothing. At this point we were fairly certain that the suspect had fled the scene, but we still needed to clear the room. We positioned the robot so we could watch the closet area, then sent in the team as we gave them updates on what the robot was seeing. At no point did we let down our guard, but we did feel much more confident about the situation before putting the officers in harm's way. That is the greatest value of the Recon Scout – it gives you greater certainty in handling a situation. It lets you know what you're up against."

The Huntington Park tactical team truck now carries the Recon Scout kit on all call-outs. It is used in a variety of high-risk sit-

uations, including a recent call out regarding a parolee who was wanted for parole violations and an attempted car-jacking. Sergeant Davis received information that he was staying at a local motel.

"We had received information that the suspect had returned to the motel early in the morning and no one had seen him leave," says Davis. "Our team attempted to contact him through the front door, but received no response. We assembled an entry team, but were reluctant to send them through the door without having more information. Using the cover of the front wall, we used our hooligan tools to break the front window and knock down the curtains that were obscuring our view. We could now see into the room, but we could not see under or behind the bed, or into the bathroom. This seemed like a perfect opportunity to use the reconnaissance capabilities of the robot, so we pulled the pin and threw it through the window."

Over the next five minutes, Detective Castelli directed the robot around the room and under the bed. Using the Recon Scout they could see in all the spots in which the suspect could be hiding, with the exception of the inside of the bathtub. Once again, Davis positioned the robot so it could watch the bathtub area as his team made entry through the front door of the room.

"If the suspect was in the bathtub as the entry team came in, the robot would have seen him and we would have warned the entry team before he could even get out," says Davis. "Because of the robot, we were 98% sure that he was not in the room, and that greater level of certainty makes for a safer operation and less damage to property."



For more information
about the Recon Scout
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1-866-697-6267 or visit
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Know Before You Go™

Safe Resolution of A Barricaded Suspect Call

Jef Behnken is a sergeant with the Burnsville, MN police department, and the team commander of the department's 16-member SWAT team. Burnsville is one of five neighboring agencies that belong to the South Metro Tactical Association, which in late 2007 acquired two Recon Scout robots in an effort to give their teams close-range tactical reconnaissance capabilities.

In September 2008, Burnsville received a call about an armed, suicidal female who was barricaded in a condominium complex and had threatened responding officers. According to Sergeant Behnken, when the SWAT team was called in, they immediately grabbed their Recon Scout.

"From day one, what we really liked about this robot was that you could just grab it and go, and it took less than ten seconds to deploy," says Behnken. "We had trained with the robot several times in 2008, so we knew exactly how our team would use it on calls like this. One of our first rules of thumb is that we do all we can before we put our officers in harm's way. This suspect had made threats to burn the building down and threatened to slit her wrists, so we took the situation very seriously. Our negotiators spent quite a while trying to talk with her, but they were not successful. We then introduced a Clear-Out gas canister, hoping that it would bring her out of the ground-floor condominium, but that too was unsuccessful."

Uncertain whether the suspect had taken her life or moved to another area of the residence, the SWAT team elected to use a non-lethal round to break out the curtained patio door to gain visual access into the environment. Behnken's team immediately found that the suspect had barricaded the door, leaving an opening only above the furniture that was piled in front of it.

"We knew that we had to get more information about the condition and location of the suspect before sending in our team, so I tossed the robot in through a small opening and began using the OCU (operator control unit) to explore the room," says Behnken. "All the while, our negotiators were continuing to try to contact her. As we moved the Recon Scout through the clutter, we could see there was nobody in the living room or the kitchen, and we could see the phone that she had used to talk to our negotiators. We used the robot to clear the entire place, except for the bathroom, which was closed up. The robot video let us see that she had stuffed towels under the door in an effort to stop the gas. We reinitiated negotiations with her,

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"Without the robot we would have had to gas the condominium with more potent and damaging gas, thereby contaminating more of the complex. And because the residence was barricaded, we would have had little idea of where she was located. This would have slowed the process and extended our time on the scene."

- Sergeant Jef Behnken, tactical team leader,
Burnsville Police Department

but she did not respond so we sent in our entry team, keeping the robot positioned at the bathroom door. Finding that the bathroom door was locked and barricaded we tried to breach the adjacent hallway wall. Almost immediately she came out the bathroom door holding 2 knives. When she did not respond to commands to drop the weapons, our officers Tasered her and safely took her into custody."

Throughout the situation Behnken had stationed himself outside the residence and used the OCU to clear the apartment to make sure certain areas were safe before his team entered. He then followed the entry team into the residence, using the OCU to scout ahead of them. Even with all the lights off in the residence, Behnken was viewing crystal clear images of the rooms. He believes that the robot enabled his team to be more confident about their movements and tactics, and helped resolve the situation more quickly. It also saved them a potentially large clean up expense.

"Without the robot we would have had to gas the condominium with more potent and damaging gas, thereby contaminating more of the complex," says Behnken. "And because the residence was barricaded, we would have had little idea of where she was located. This would have slowed the

process and extended our time on the scene."

Burnsville SWAT now takes its robot on every operation. Each SWAT member has been trained in its operation, and they all know the protocols for using it

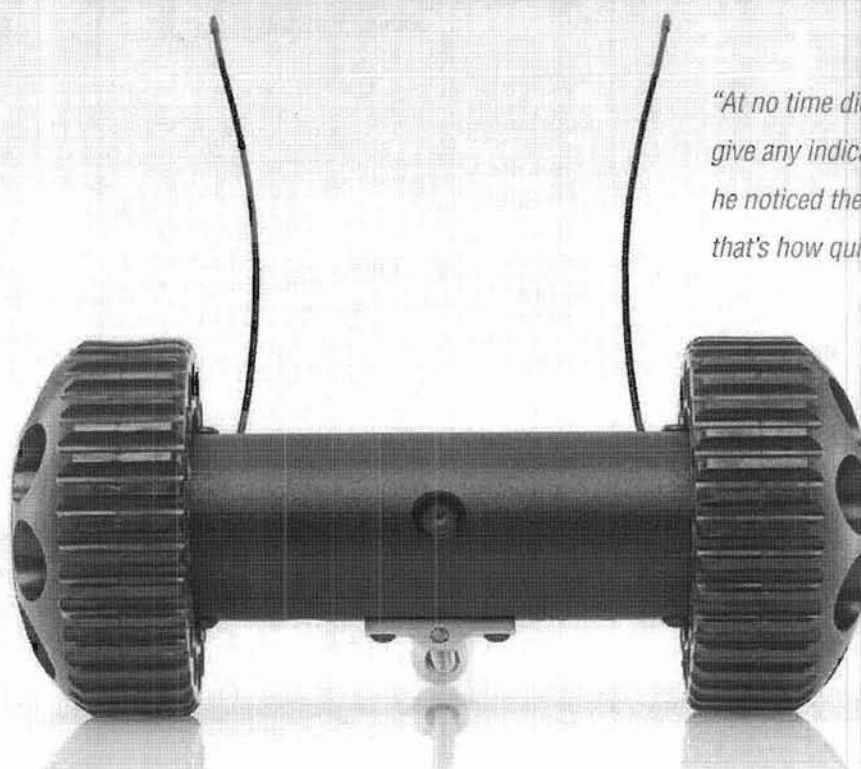
"The robot enables us to make smart decisions as we go, and it is incredibly easy to use, says Behnken. "It is kept in my office and we just grab it and go."

Summary

- | | |
|------------------|---|
| Agency | • Burnsville Police Department, Burnsville, Minnesota. Population 60,220 |
| Challenge | • Resolving dangerous situations while limiting risk to the tactical team
• Conducting reconnaissance of barricaded environments in advance of the entry team |
| Solution | • Deploy a Recon Scout mobile reconnaissance robot to assist in clearing rooms and locating the suspect |
| Benefits | • Robot is very small; team can just grab it and go
• Robot can be thrown through a window or other small opening to gain access
• Tactical team leaders can explore an environment in advance of the entry team
• Provides clear, crisp video even in very low ambient light
• Reduces damage to property, and limits department liability |

Orlando Police Department - SWAT

Gaining Inside Knowledge About A Barricaded Gunman



"At no time did the suspect give any indication that he noticed the robot, that's how quiet it is."

Dave Arnott has been with the Orlando Police Department for 19 years, and a member of the SWAT team for 11 years. He is also the director of operations for the Florida SWAT Association. Currently an assistant SWAT team leader in Orlando, Arnott has used a lot of new technology over the years in an effort to protect his team and the public from harm. In December 2007, he had his first opportunity to use the Recon Scout mobile reconnaissance robot on a call involving a barricaded gunman.

"We first saw the Recon Scout in January 2007 at a National Tactical Officers Association training event that we hosted here in Orlando," says Arnott. "This event gave us an opportunity to train with the Recon Scout and see how we could use it in common tactical situations."

According to Arnott, he and other members of the team immediately thought the Recon Scout could be a useful tool in helping them gain inside information about dangerous situations. "The first thing we noticed was that we could use this robot in a very mobile fashion," says Arnott. "It is very small and you can easily carry it with you, and it won't slow you down. The other thing that appealed to us was that it was durable — you could throw it over a wall or through a window or door, and it would be ready to go. But the most important thing was that once you got the Scout into a situation you could, from a safe distance, use the controller to move it through the

Summary

Agency Orlando Police Department
Orlando, Florida
Population: 900,000

Sector Police Tactical

Challenge

- Assess a potentially dangerous situation without placing officers in harms way
- Obtain real-time inside information on barricaded suspects or hostage situations

Solution

- Purchase and deploy a Recon Scout mobile reconnaissance robot.

Benefits

- Affordable and can be used in many tactical situations
- Robot is small; can be carried in a pocket or on a vest
- Can be thrown through a window or door, or over a wall
- Can be driven remotely to explore an environment
- Able to transmit clear real-time video through walls up to 50 yards

For more information
about the Recon Scout
throwable reconnaissance
robot, please call
1-866-697-6267 or visit
ReconRobotics.com.

RECON > ROBOTICS

environment and send back real-time video. We have used video-equipped robots that you can throw, but they stop when they land and you can't explore other rooms. We have also used robots that move, but they are too large to carry or throw so they are ineffective on most calls. It was the multi-use capability of the Recon Scout that really appealed to our team – not only could we carry it and throw it, but we could also then guide it through the environment to learn more about a given situation."

Orlando SWAT purchased a unit in November 2007, and immediately trained all team members in its use. It wasn't long before they had a chance to put it to the test.

In January 2008, the Orlando SWAT team was called out to an apartment complex where an armed man was barricaded in his apartment. It had been reported that the man had shot at his spouse and was armed with semi-automatic rifles – including an AK-47. According to Arnott, much of the complex was being held hostage just by the mere fact that the suspect could easily fire into any of the nearby apartments.

"We set up a perimeter and neutralized the situation so he couldn't get out, but we couldn't get in either," says Arnott. "It was a two-story apartment and we felt that we needed more information about the situation – including the exact location of the suspect – so we breached a 2nd story window and threw the Recon Scout through the window. It went in fine and landed on the floor. From a safe distance away we used the Recon Scout's video camera to scan the room, but we did not see the suspect. Using the controller we then drove the robot into another room where we found the suspect lying on the floor between the bed and the wall, trying to conceal himself from a nearby window. We were also able to scan the rest of the apartment to make sure that no one else was with him – either a hostage or an accomplice. This was very good to know because your tactics change dramatically if there are hostages or other adversaries present. At no time did the suspect give any indication that he noticed the robot, that's how quiet it is."

At the time that the robot was moving through the apartment, the officer controlling its movement was more than 50 yards away on the opposite side of the four-unit building. "What was remarkable, was that we were able to get very clear video even though it was being transmitted through several concrete block walls over a considerable distance," says Arnott. "Once we had a clear picture of the situation, we felt that the time was right to tactically introduce gas into the apartment. We threw in gas canisters, and even with the gas in the room we were able to use the Recon Scout optics to see the suspect stand up and move towards the stairs. Seeing that he was unarmed, we alerted the team, which arrested him as soon as he exited the building."

"The Scout is very affordable and easy to use.

We use it in any situation where we will need to clear rooms," says Arnott. "Its mobile eyes allow us to accomplish this task very quickly."

-- Dave Arnott, Assistant Team Leader Orlando SWAT

According to Arnott, the versatility of the Recon Scout helped resolve this situation quickly and safely. "There are so many camera systems out there that you put through the wall or under the door, but their views are restricted and you have to get very close to the situation to use them. With the Recon Scout we were able to throw it in, drive it around, and clear the entire second floor. Once inside we were able to determine exactly where the suspect was, that he was un-armed when he stood up, and that he was coming out by the stairway. Without the robot we would not have determined any of that information and this situation might have lasted several more hours or ended differently. This robot enabled us to learn at a distance what's going on and keep our officers out of harms way."

Today, Orlando SWAT takes the robot on just about every call, including search warrants. "The Scout is very affordable and easy to use. We use it in any situation where we will need to clear rooms," says Arnott. "Its mobile eyes allow us to accomplish this task very quickly."



RECON SCOUT™

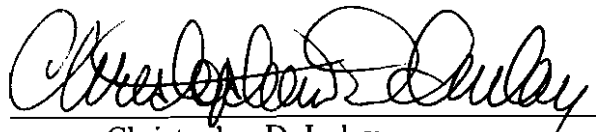
Know Before You Go™

CERTIFICATE OF SERVICE

I, Christopher D. Imlay, do hereby certify that I caused to be mailed, via first class U.S. Mail, postage prepaid, a copy of the foregoing **PETITION FOR RECONSIDERATION** to the following, this 24th day of March, 2010.

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Christopher D. Imlay